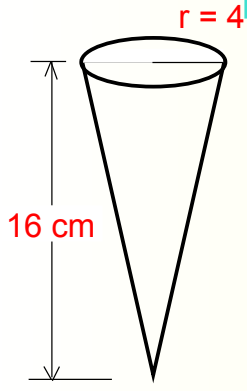
Calculus Warm Up #4-3

$$V = \frac{1}{3}\pi r^2 h$$

$$\frac{dV}{dt} = \frac{\pi}{3}\left[r^2\frac{dh}{dt} + 2rh\frac{dr}{dt}\right]$$



Volume is changing at a rate of 2 cm^3/min.

Find an expression for the change in the height of the water over time, then find that rate when the height is 5 cm.

Sometimes this cone problem is easier without so many variables...

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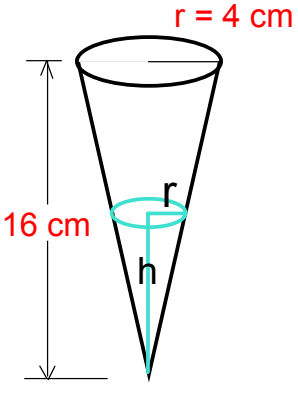


$$\frac{dV}{dt} = \frac{\pi}{3}\left[r^2\frac{dh}{dt} + 2rh\frac{dr}{dt}\right]$$

HW Questions: p. 148

In Exercises 1–4, assume that x and y are both differentiable functions of t and find the indicated values of dy/dt and dx/dt.

	Equation	Find	Given
1.	$y = \sqrt{x}$	(a) $\frac{dy}{dt}$ when $x = 4$	$\frac{dx}{dt} = 3$
		(b) $\frac{dx}{dt}$ when $x = 25$	$\frac{dy}{dt} = 2$
2.	$y = x^2 - 3x$	(a) $\frac{dy}{dt}$ when $x = 3$	$\frac{dx}{dt} = 2$
		(b) $\frac{dx}{dt}$ when $x = 1$	$\frac{dy}{dt} = 5$
3.	$xy = 4$	(a) $\frac{dy}{dt}$ when $x = 8$	$\frac{dx}{dt} = 10$
		(b) $\frac{dx}{dt}$ when $x = 1$	$\frac{dy}{dt} = -6$

$y = \frac{4}{x}$

$y = 4x^{-1} \rightarrow \frac{dy}{dt} = -\frac{4}{x^2}\frac{dx}{dt}$

5. The radius r of a circle is increasing at a rate of 2 inches per minute. Find the rate of change of the area when (a) $r = 6$ inches and (b) $r = 24$ inches.

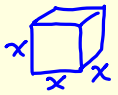
6. The radius r of a sphere is increasing at a rate of 2 inches per minute. Find the rate of change of the volume when (a) $r = 6$ inches and (b) $r = 24$ inches.

7. Let A be the area of a circle of radius r that is changing with respect to time. If dr/dt is constant, is dA/dt constant? Explain why or why not.

8. Let V be the volume of a sphere of radius r that is changing with respect to time. If dr/dt is constant, is dV/dt constant? Explain why or why not.

9. A spherical balloon is inflated with gas at the rate of 20 cubic feet per minute. How fast is the radius of the balloon increasing at the instant the radius is (a) 1 foot and (b) 2 feet?

13. All edges of a cube are expanding at the rate of 3 centimeters per second. How fast is the volume changing when each edge is (a) 1 centimeter and (b) 10 centimeters?



$V = x^3$

$\frac{dV}{dt} = 3x^2 \frac{dx}{dt}$ $\qquad \frac{dx}{dt} = 3$

15. A point is moving along the graph of $y = x^2$ so that dx/dt is 2 centimeters per minute. Find dy/dt when (a) $x = 0$ and (b) $x = 3$.

17. A point is moving along the graph of $y = 1/(1 + x^2)$ so that $dx/dt = 2$ centimeters per minute. Find dy/dt for the following values of x.

(a) $x = -2$ (b) $x = 0$

(c) $x = 2$ (d) $x = 10$

$y = (1+x^2)^{-1}$

$\frac{dy}{dt} = -1(1+x^2)^{-2}(2x)\frac{dx}{dt}$

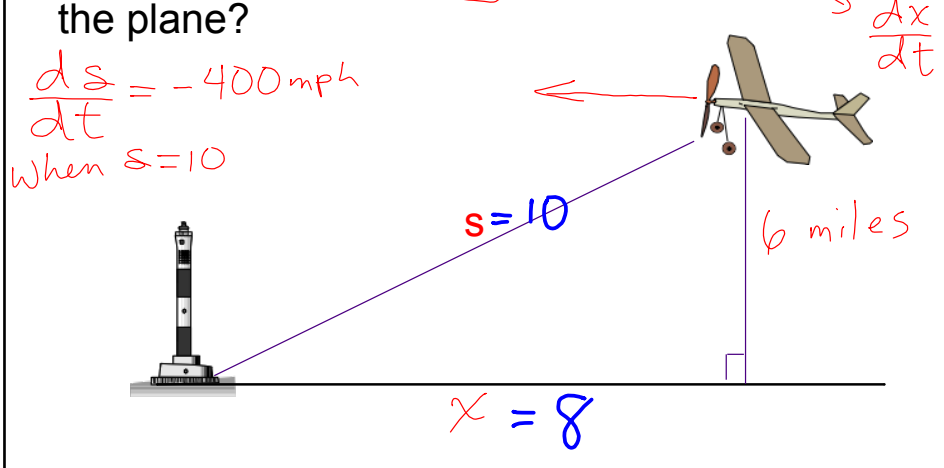
a) plug in $x = -2$ and $\frac{dx}{dt} = 2$ →

$\frac{dy}{dt} = \frac{-2x}{(1+x^2)^2}\frac{dx}{dt}$

An airplane is flying at an elevation of 6 miles on a flight path that will take it directly over a radar tracking station.

$x^2 + 6^2 = s^2$

Let s = distance in miles between the radar station and the plane. If s is decreasing at a rate of 400 mph when s = 10, what is the velocity of the plane?



HW:

p. 149 # 11, 21, 23, 25, 29

and p. 151 ch.3 review

3-9 odd, 15, 19, 21